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A Diploma in Medical Jurisprudence

The Society of Apothecaries of London has instituted an examination for a diploma in medical jurisprudence. This Society is the first and only examining body in the United Kingdom to have shown any initiative in the inauguration of such a diploma.

The examination is divided into 2 parts:

Part I: The Primary Examination, in basic matters related to all branches of medico-legal practice. This does not carry a Diploma.

Part II: The Final Examination, which may be taken in either or both of two branches:

(*a*) Clinical—to be registered D.M.J. (Clin.).

(*b*) Pathology—to be registered D.M.J. (Path.).

The Examination is open to registered medical practitioners who have had experience of medico-legal practice.

The Examination is held twice yearly.

Part I begins on the last Monday in the months of April and October.

Part II begins on the second Monday in May and November.

The written examination takes place at Apothecaries' Hall, Black Friars Lane, London, E.C.4. Candidates will be notified about the time and place at which their *viva voce* and practical examinations will be held.

The details of the syllabus are likely to receive criticism, e.g. in Part II (*Clinical*) it is undesirable, unnecessary and impracticable to require a medical practitioner to be capable of making a toxicological identification of common poisons. This is the task of the chemical expert.

The interpretation of the medical and scientific findings in cases of disputed paternity had also better be left to the serological experts regularly engaged in this kind of work. Presumably no more than the principles of inheritance of blood groups and the principles involved in their scientific application, is required. The scope of this kind of work which the candidate must profess needs considerable clarification throughout the syllabus.

In paragraph 8 'differential diagnosis between drunkenness, the effects of drugs, certain diseases and the effects of head injuries' could have been

stated more appropriately and accurately as 'the differential diagnosis of acute alcoholic intoxication.' The 'principles of analysis for alcohols' are most certainly a matter for the organic chemist.

It is also not clear how the holder of this Diploma becomes an expert, *inter alia,* on psychiatry, testamentary capacity, drug addiction, sexual deviation, suicide and industrial and insurance medicine. If it is intended to train him so that he should be aware of what experts to call upon, a case can be made out for this kind of instruction; but if this qualification is intended to make him an expert in a diversity of highly specialized fields of medical practice, it is likely to meet with a disastrous fate in our Courts.

In Part II (*Pathology*) the examiners (and instructors) should guard against the temptation of turning the forensic pathologist into a kind of medical bloodhound. The collection of trace evidence and the use of photography are largely matters for the investigating police officers. Tradition and duties may, however, vary in different countries.

By and large the medical practitioner should be required and taught to make a medical contribution—not that of the sleuth. Likewise, in the identification of human remains it would be unwise to expect anyone other than a dentist to give expert testimony on forensic odontology; and it is difficult to appreciate why a *medical* diploma must require the holder to have knowledge of modern analytical toxicological methods. This seems out of place in the training of a forensic pathologist, as the service must undoubtedly be rendered by a trained organic chemist, and not by a medical amateur or dilettante.

Despite some shortcomings in this first draft of a syllabus for a Diploma in Medical Jurisprudence, it is to be welcomed as a pioneering effort. The architects of the project will no doubt modify matters in the light of experience gained in the operation of the scheme, and so produce a course which in due time may be generally acceptable.

The Regulations governing admission to the examination are published elsewhere in this issue.

Further information may be obtained from:

The Registrar, Apothecaries' Hall, Black Friars Lane, Queen Victoria Street, London, E.C.4, England.

Medico-Legal Society's Diamond Jubilee

Dr. Keith Simpson: Jubilee Year President

This well-known Society celebrates its diamond jubilee this year. Despite a false start in 1887 to found such a society, the second attempt in 1901 was successful.

At its inception, the Medico-Legal Society attracted 65 members. These have grown more than tenfold in the 6 decades of the Society's existence. Many distinguished legal and medical practitioners have held high office in the Society, which has included amongst its Presidents Lord Riddell, Sir Bernard Spilsbury, Mr. Justice Humphreys, Sir Roland Burrows and Sir Norwood East.

The Medico-Legal Society is also responsible for one of the oldest forensic journals published in English, viz. the Medico-Legal Journal, now edited by Dr. Gavin Thurston. The Journal was founded in 1901 and continues to play an important part in the field of medico-legal journalism.

Dr. Keith Simpson, Head of the Department of Forensic Medicine, Guy's Hospital, London, has recently been elected President—a fitting recognition of his eminence in this field and of his distinguished contributions to the practice of forensic pathology. Dr. Simpson is the first forensic pathologist to hold office as President since Sir Bernard Spilsbury occupied the presidential chair.

The Development of Scientific Methods in Crime Investigation*

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The development of technical method has always proceeded at a pace determined largely by the invention of tools. Long periods of gestation and a tardy exploration of fields of science in which some original observation of vital interest and potential has been made have usually been caused by lack of instruments. The microscope, for so long limited in its effectiveness by the difficulty of harnessing anything but natural light, has (since the development of prismatic, dark ground, phase contrast and electron techniques, and of high-speed photomicrography) become a new instrument. The separation of chemical substances received a remarkable fillip with the development of the Stas-Otto extraction process, another with flame photometry, the colorimeter and paper chromatography, and yet another burst of speed with X-ray diffraction methods. Electricity and electronics have revolutionised physical measurements by providing measuring instruments that transform light or sound into electromotive force, transmit and automatically record quantity with accuracies undreamed of.

The Era of Empiricism

When we look at the processes of criminal law in early times we can but be appalled at their insecurity as a foundation for justice. Even literate civilizations like those of Egypt, Sumeria, Babylon, of India and China, lacked scientific aids of any kind. Anatomy was evidently studied—both the Edwin Smith papyrus and that of Ebers give evidence of a knowledge of medicine and of surgery. Imhotep, Chief Justice and Physician to King Zoser in 3,000 B.C., might perhaps lay claim to be the first medico-legal expert, but his reputation rested on empiricism and irrational deduction: poisons and antidotes were known—and used, but there was no means of detecting or measuring them except by the coarse biological assay of trial. Pliny tells us that the bodies of those who died were examined, but the records do not tell us much of the results. Disputes over virginity, problems of marriage, legitimacy, rape, embalming and the disposal of the dead occupied much of the time of the experts of the day, and the decisions that

* An address given to the *British Society for the History of Science* at the Science Museum, Kensington, London, on 27 February 1961.

were made were—with the exception of the science of embalming—anything but scientific.

Neither the Roman nor the Byzantine era contributed much to medicine or science. In A.D. 19 Germanicus' death was attributed by one side to poisoning, by the other to natural heart disease—both on the grounds that the heart did not burn! As Sir Sydney Smith has pointed out, the Justinian enactments, on reflection, look almost as if they were intended to be a lasting memorial to the fading greatness of Rome. Worse was, of course, to follow. The scientific lights of Europe went out for centuries—extinguished, not a few aver, by the teachings of Galen. Some light which appeared in the East—a work entitled *Hsi Yuan Lu*—(reviewed by Prof. H. A. Giles in the *Proceedings of the Royal Society of Medicine* (*Section on the History of Medicine,* in 1924)) remained out of reach of European medico-legists. It would have been of tremendous value to those shouldering the responsibility of the investigation of crime during the Middle Ages, for it dealt (and dealt well) with such problems as the study and interpretation of wounds as a check on the validity of statements, the differentiation of suicidal and homicidal strangulation, immersion of the dead—as distinct from the living, ante- and post-mortem burning—and many other everyday puzzles which are now approached on much the same fundamental principles, if aided by blood and tissue analysis and microscopy.

A *Constitutio Criminales Carolina* proclaimed by Charles V, extending the well known Bamberger Code in 1533, was the first European law to insist on expert medical testimony before the judge in cases of murder, wounding, poisoning, hanging, drowning, infanticide and abortion. This root flourished and rapidly spread to France, Austria and Italy. An Italian physican, Fortunato Fideli, wrote a 4-volume medico-legal magnum opus in 1602—*De Relationibus Medicorum,* and Paul Zacchia, physician to the Pope, followed (between the years 1621 and 1635) with his remarkable *Questiones Medico-Legales.* In France, Ambroise Paré and Louis; in Denmark, Bartholin (who first introduced a hydrostatic test for new-born lung); in Germany, Plenck and Metzger; and in England, Samuel Farr all made important literary contributions to the subject. The 18th century closed with one of the greatest contributions of all time—the *Traité de Medecine Légale et Hygiene Publique* of Fodere—which formed the link between the older empirical and the modern scientific approach to problems of crime investigation. The microscope had made its impact.

The First Scientific Era

It was undoubtedly the 16th and 17th century development of the lens and from it the microscope that broke the empirical shackles of the centuries. Malpighi, Hooke, Swammerdam, de Graaf and von Leeuwen-

hoek poured discovery after discovery into the field of microscopic anatomy in the worlds of biology, medicine and science.

'Of all the inventions none there is surpasses the Noble Florentine's (i.e. Galileo) Dioptrick-glasses,

For what a better fitter guift could bee in this world's Aged Luciocity,

To help our Blindnesse so as to devize a paire of new & artificiall eyes,

By whose augmenting power wee now see more than all the World Has ever done Before.' (*Dr. Henry Power*, 1661).

Scientific advances undoubtedly gave a fillip to medical progress during this period, but the flow was not by any means all in one direction. Gilbert, who was personal physician to Queen Elizabeth I, published in 1600 his *De Magnete*, and, as Professor Allsopp pointed out in the *British Journal of Applied Physics* in 1957, his experiments described therein undoubtedly form the basis of modern electrical theory. Thomas Young, who (with Helmholtz) formulated the first wave theory of light, practised medicine in Welbeck St., London, at the turn of the 18th century. A distinguished physician, Richard Mead (1673-1754), who was executor to Thomas Guy, founder of Guy's Hospital, wrote, in the *Preface* to *A Mechanical account of Poisons*, published in 1702:

'It is very evident that all other Methods of improving Medicine have been found Ineffectual by the Stand it has been at these Three or Four Thousand Years; and that since of late Mathematicians have set Themselves to the Study of It, Men do already begin to talk so Intelligibly and Comprehensibly, even about abstruse Matters, that it may be hoped in a short Time, Those who are Designed for this Profession are early, while their Minds and Bodies are Patient of Labour and Toil, Initiated in the Knowledge of Numbers and Geometry, that Mathematical Learning will be the Distinguishing Mark of a Physician from a Quack; and that He who wants this necessary Qualification will be as Ridiculous as One without Greek or Latin'.

A very similar plea, which I will not quote at length, came in 1700 from John Quincy in his *Lexicon Physico-Medicum*. Carried away a little perhaps by his special knowledge of the 'Laws of Motion, Gravitation, Air, Winds, Tides, Light, Heat, Cold and the like' he warned that 'Points of Practice, without such previous Lights, must lie entirely in confusion, and upon the Hazard of Experiment and Guesswork'.

Coroners and Law Enforcement Officers had, until this period of early scientific development, had recourse to the anatomist and such medical men as were interested in dissecting the body for evidence of disease or to elucidate injury. Chemistry was in its infancy and toxicology concerned itself with symptomatology and dosage—and sometimes antidotes, but not with the analysis of organs. Bohn, in Leipzig, published in 1689 the first comprehensive treatise from a mid-European expert—*De Officio Medici Duplici, Clinici Nimirum ac Forensis* and a *Corpus Juris Medico-Legale* by Valentini in 1722 at last ousted the out-dated Zacchia in Italy. In France Louis' *Memoires*, dated 1788, was succeeded in 1796 by Fodere's classic *Traite de Medicine Legale et Hygiene Publique*. In England

Samuel Farr (1788), Andrew Duncan (1789), Smith (1821) Christison (1829) Paris and Fonblanque (1823) and the famous Alfred Swaine Taylor (*Poisons* in 1848), whose original *Principles and Practice of Medical Jurisprudence* (1865) I now have the honour to edit with Sir Sydney Smith, all of these sustained British interest in the developments of scientific crime investigation.

Early Criminal Detection Procedure

Although for so many centuries the need for an investigation of all violent and unexpected deaths must have been evident to everybody, law enforcement made remarkably little use of experts in the growing fields of either medicine or science. The *Constitutio Criminalis Carolina* of the mid-16th century was the first European enactment to authorise the services (and, where necessary, the evidence at enquiry) of experts in the field, and this was not, of course, binding on the English Coroner, who had by then existed for over 500 years. The Normans had levied a 46 mark fine called a *murdrum* on any district in which an unexplained death had taken place—unless Englishry were proved: the English were expendable. The *deodand* or object responsible for the killing in cases of felony was forteit, and for centuries the 'crowners', as they were then called, profited not a little by this means. The investigation of such deaths must have required some skill and experience for a fair decision to be reached, and one might have expected 'crowners' to seek professional advice on the interpretation of the findings in the dead. They did not. All too little attention was paid to the evidence that medicine and developing science might have extracted at autopsy. Cases were decided on the circumstantial evidence and the interpretation of wounds: surface marks were all that counted and much nonsense (often frank quackery) was talked and recorded. Little or nothing was known of the many natural diseases which are now so often shown at autopsy to be capable of arousing suspicion of foul play. Two famous trials which took place as late as 1678 (that of 3 men for the murder of Sir Edmundbury Godfrey) and 1699 (that of Spencer Cowper for the murder of the girl Sarah Stout), produced much conjectural and imaginative evidence which would certainly not withstand a present-day cross-examination. The infamous Titus Oates gave evidence at the first of these, and this is hardly likely to have added much to the justice of the occasion.

Another difficulty was placed in the way of coroners' using the services of experts: they had no authority until 1836 to pay fees for such help, but had to seek a magistrate's authority for expenses incurred in this way. Of course the system failed, for magistrates and coroners viewed each other's authority and privileges with dislike and did all that was possible to frus-

trate each other. Ultimately, by 6 & 7 Will.IV.c.86, this difficulty was disposed of. In 1845 the old Bills of Mortality, first kept by the parish priest on an order of Cromwell in 1538, were replaced by the English death certificate, and a real interest in the accuracy of the stated cause of death began to develop.

Nineteenth Century Technical Advances

Nicol's development in 1828 of the calcite prism for crystallography, now replaced by a synthetic polaroid, opened up a new field for microscopy, and the development of studies in diffraction phenomena also extended the power of the microscope, but it was still shackled by the limit to which ordinary light sources could increase resolution. Abbe's partnership with Zeiss from 1873 on, the dispersal of chromatic aberrations and the development of the oil-immersion lens, undoubtedly paved the way for the remarkable later 19th century discoveries of Virchow in cellular pathology, of Pasteur and Koch in bacteriology, and of Eberth and Laveran. The slow progress of clinical medicine, even in the hands of such brilliant men as Astley Cooper, Bright, Addison and Hodgkin, to name 4 in just one London hospital, stemmed from the lack of instruments such as these. Successively, polarizing, dark-ground, diffraction and finally Zernicke' phase contrast methods of resolution, defined detail that laid discovery after discovery before the eye.

The invention of the flame photometer by Bunsen and Kirchhoff in 1859 set off another most productive field—that of spectrum analysis. Fraunhofer's viewing telescope with a mirrored scale provided the ideal complement. Haemoglobin in blood became easily detectable from other red matter and its crystalline compounds added detail to 'blood tests' of the day. Emission spectrography was not yet due or the police search for trace contacts might have had an early start.

Criminal investigation did not make strides commensurate with these advances. For the vast majority of microscopical examinations that were —and even now are made in the fields of dactylography, ballistics, the biology of hair cuticle and structure, even of the dusts from turn-ups of suspect housebreakers and safe-pickers, do not require this degree of resolution. Only in the field of cell-sexing by nuclear structure, elaborated by Barr and his colleagues during the last 10 years, has mitochondrial form been in demand. The simple sexing of blood from white cell nuclear form described in 1954 by Davidson could have closed one of the major gaps in scientific crime investigation over 50 years before. Crippen's victim could have been sexed beyond argument in an hour.

During this same *fin de siecle* period, another remarkable 'instrument' in crime detection—the finger print—came to the notice of the police. It

was an English development, and I should like to devote some short time to its history.

Purkinje (the Breslau physiologist) had, in 1823, submitted a thesis entitled *Commentatio de Examine Physiologicae Organi Visus et Systematis Cutanei,* naming 9 types of finger print. Whether he had seen Thomas Bewick's 'mark' as a wood engraver's signature (most beautifully executed, for instance, in the illustrations to an Easop's *Fables* in 1818), we do not know. There was no doubt, of course, that finger and thumb impression had been used centuries before in both China and India as trading signatures: in the Assyrian Room of the British Museum are many bricks so marked, and archeologists studying this period frequently find ball prints on pottery. An interesting document still lies in the Cathedral of St. Columb in Londonderry. It is dated 1691 and demands to see 'the King and Parliament' to ask for compensation for losses during the siege of Derry. To it are affixed both signatures and finger and thumb prints —presumably as marks for any who could not write.

But Purkinje seems to have been the first to attempt any systematic description of finger prints in his 1823 thesis—and it was forgotten, or at least its forensic possibilities were not extended. No one foresaw the immense service these common marks were to give to criminal investigation, until William Herschel and Francis Galton, some 50 years later, interested themselves in its astronomical pattern potential—and its immutability. It remained for Henry, an English civil servant who had seen this signature in India during Government service there, to envisage its possibilities in police work. In 1900, he presented his arguments to a Departmental Committee appointed under the chairmanship of Lord Belper, and in this he was ably supported by Galton. Henry was, in fact, able to quote a conviction for murder in Bengal which had relied on the finger print for proof of identity—and was followed by a confession. The system was adopted by the English Police and a Department was set up at New Scotland Yard, where Sir Edward Henry shortly became Commissioner. He had already paid dutiful compliment in his first major work on the subject —published in 1895—to the pioneer work of Herschel 'in employing finger prints as an official signature nearly 40 years ago'.

The system has been an unqualified success, and has never been successfully challenged in criminal procedure in court. I happened to have been engaged in the first case in which a palm print secured a conviction for murder—in a safebreaking killing at Shoreditch in the early 1940's; and in another remarkable case, the Luton sack murder, where an old and dusty print on a pickle jar was vital to the Crown's proof of identity in a charge of murder, the unquestionable accuracy of this system carried the prosecution. No 2 similar prints have ever been recorded, unless from the same finger: Cherrill, the Yard's famous finger print expert, quotes

Galton in his H.M.S.O. monograph of 1954 as estimating that the possibility of error lies in the region of 1 : 64,000 million—many times the world population. Karl Pearson may not have liked either Galton's or Cherrill's statistical estimate, but the possibility of error is undoubtedly too remote to leave evidential doubts.

Within a year or two of inception, the Yard's finger print system became a model for world practice. Lt. Fauret of the New York City Police and a Col. Clark of the Natal Police Force were in London to study this new method of identifying the criminal. The anthropometrical system of Berthillon was superseded. By 1921 Charles Collins, the Inspector in charge, had perfected *A Telegraphic Code for Finger Print Formulae* and in 1930 the *Single Print System* had largely replaced the original *Main Finger Print Collection*. Radiophotography now circumvents the globe for Interpol, and a whole day is seldom necessary in order to receive information, search the records and flash back the reply to any part of the world.

The Criminal Justice Act of 1948 finally set the seal upon this system by enacting (sect. 39) that finger prints shall in themselves be sufficient proof of a person's previous convictions.

Modern Times and Methods

It had become apparent by the 1930's that the somewhat haphazard use of chemists, handwriting and typewriting 'experts', biologists and serologists, physicists—whose experience was all too often stretched into the field of explosives and ballistics (though often by men of great ability like Ainsworth Mitchell, Roche Lynch, Ryffel and Churchill) was unsatisfactory, and Lord Trenchard established the first Police Forensic Science Laboratory at Hendon in 1934. It was a long time before CID officers without scientific senses became aware of the help that could be obtained from the expert and his specialized equipment of this and the other Home Office Forensic Science Laboratories that formed the skeleton of the country-wide service that Trenchard had envisaged; but results brought increasing collaboration and the scientific laboratory services rapidly found themselves under the pressure that success brings. Well qualified and authoritative evidence at Court set the seal on this ancillary Police service, and the next stage—shortage of staff—became a real problem that has not yet been solved. Libraries of firearms, papers, woods and fibres, plastics and glasses, drug preparations and dusts now lie to hand for comparison, and expert toxicological analysis is readily available. The Police Officer knows from his training that he can get expert assistance in literally any field of science that holds up his enquiries—from metallurgy to meteorology, from seeds and soils, fungi or fish scales to blood and beer bottles.

It is only in problems of medicine and pathology that independent consultants' help is likely to be sought, and this is likely to continue.

Perhaps I might take one physical and one quasi-medical field in which science has made important contributions in recent years: ultra-violet photography (rather than spectroscopy's more limited field) and that of serology.

Ultra-violet Photography. Many organic dyestuffs, paints and biological materials such as seminal fluid, fluoresce under ultra-violet light and the Woodsglass filter has been in use for a hundred years (since George Stokes first described the phenomenon) as a means of 'picking off' significant stains in clothing for further test. Radiations between 100 and 4,000 Angstrom units and more particularly those in the region of 2537 Å and 3654 Å from a high-pressure mercury vapour lamp enclosed in a quartz tube, can be put, with the Woods glass, to a remarkable number of uses. Erasures in leather and on documents or insurance stamps, forgeries in wills or Road Traffic Act licences which are invisible to the relatively insensitive naked eye in daylight, can be revealed—and photographed—by the use of ultra-violet light, either because of the varying fluorescence of different inks and dyes or by the cultivated sensitiveness of specially prepared photographic emulsions. Absorption spectrometry has more recently added a quantitative measure to this 'secret eye', but the field has not yet been far explored in criminal investigation. Finger prints can be developed with a fluorescent powder such as anthracene and thus revealed against a background which might otherwise conceal them, and many 'invisible' laundry marks, especially in the clothing of long dead and buried or immersed persons, come clearly to light when examined by ultra-violet methods: the dye p-dihydrothioparatoluidine was in common use in laundries for marking purposes, but seems now to have been superseded by the temporarily attached number tag.

In the arts, ultra-violet fluorescent and photographic methods have been particularly useful in detecting forgeries, and repairs of glass figures and ceramics, especially of porcelain figures, have frequently come to light—to level the sale prices of valuable Meissen, Stafford and similar pieces. Marble repairs and bronze solderings have also been detected in works of art which would otherwise have passed as perfect. The famous van Meegheren forgeries came to light as a result of fluorescent, ultra-violet and X-ray photographic methods of examination.

Serology. Since Medea attempted to rejuvenate old Anchises by replacing his blood with that of youths (Ovid), interest has attached to the possibility. Pope Innocent VIII received the blood of 3 boys and in 1667 Denys and Emmerez successfully transfused the blood of a sheep into man. But so many disasters befell those who experimented that it was evident that blood, like all living things, had individuality. It fell to Karl Lansteiner in 1901 to identify the A, B and O groups, and to Decastelo

and Sturli, a year later to identify the much rarer AB group. By 1927 Landsteiner and Levine had discovered the M and N patterns and, with Wiener, in 1937 Landsteiner made the epoch-making revelations about the Rhesus types that explained so many transfusion disasters and, more, cleared the air on the erythroblastosis foetalis complex. Mendelian inheritance laws were confirmed. Blood had indeed become an individual, serologically speaking. Whereas, in the first 40 years of the present century, it was not particularly risky for a group A or O criminal to leave a trace of his blood at the scene, it is becoming an increasingly incriminating thing to do. Blood is no longer just A or B, it may well be A_1 (subgroup) B, M, Rh positive (phenotype CDe/cde), Lu(a_1), K, and more.

In 1949, at a Scottish Sheriff Court, man charged with carnal knowledge of a girl under 14 who had had a child allegedly by him was found to lack the antigen C possessed by the infant and lacking in the mother. The father must have been of the rare genotype Cde/cde—(only 0.76% of the population lie in this group) and an acquittal quite properly followed in spite of a warning by the Sheriff to assess the scientific evidence—on the Mendelian inheritance of blood character—with care!

The soundness of the inheritance 'laws' for blood groups first enunciated by Bernstein in 1925 has resulted in legal enactments, first in New York in 1935, demanding blood tests in disputed paternity issues, and many countries have by now followed suit. In Scandinavia the official report of the Medico-Legal Council now relieves the serologist from court attendance unless cross-examination is proposed, and this is by now rare indeed. It is sad that the Second World War killed Lord Merthyr's *Bastardy Bill* in England but this has now been revived.*

Group specific substance have also been shown to be present in saliva, sweat and other secretions of the 'secretor' proportion of the population, and the discarded cigarette end or a little slobber on the pillow may now carry far to link a suspect with the scene. Sherlock Holmes would have revelled in the modern scientific method: each year evokes new theories and sometimes also reliable new methods of investigation. We might indeed say, with E. L. Maskall (*Pi in The High,* 1960):

> Hark the herald angels sing
> Bultman is the latest thing
> (or they would if he had not
> demythologized the lot).
> Joyful all ye nations, rise
> Glad to existentialise!
> Peace on earth and mercy mild
> *God and science reconciled.*

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* *See* Grant, A. (1961): J. Forensic Med., **8**, 80.

A Swab in the Bronchus: A Medico-Legal Problem

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This case illustrates the difficulties which may arise at an Inquest when a surgical swab is found in the air passages at autopsy.

Tracheotomy is to-day common in the treatment of patients unconscious due to head injury, and it is possible that the problem encountered here may recur. It is therefore useful to know that the removal of the cervical and thoracic organs by a commonly used autopsy technique can result in downward displacement of foreign bodies present in the trachea.

Case Report

A middle-aged man was admitted to hospital unconscious, shortly after being knocked down by a motor-car. When resuscitative treatment had been started, he was taken to the operating theatre where a tracheotomy was done before an exploratory craniotomy. Extensive linear fractures of the skull were seen, and a large extradural haematoma was evacuated.

The patient never regained consciousness, his condition remaining critical. Respiration was persistently 'moist,' necessitating frequent suction through the tracheotomy tube. The inner tube was removed and cleaned every 2 hours by a senior nurse.

Twelve days after admission the patient's condition suddenly deteriorated, with gasping respiration, and he died 15 minutes later. After the laying out procedure, carried out by junior nurses, the body was sent for autopsy.

Autopsy Findings

The autopsy report described the following relevant findings:

i. In addition to the factured skull noted at operation, extensive contusion of the brain was disclosed, involving mainly the right frontal and temporal lobes.

ii. The tracheotomy tube had been removed and the wound covered by a piece of gauze held in place by adhesive strapping.

iii. A gauze swab was found in the right main bronchus. It was made of wide-mesh gauze, folded to 3 thicknesses, to form a rectangle 2 inches by 3 inches. It was tightly rolled to form a cylinder which tapered at both ends and was about 3 inches long. At least two thirds of this cylinder lay within the lumen of the right main bronchus. The remainder protruded from the bronchus and lay across the carina, partly obstructing the left main bronchus. The swab was saturated with mucus secretion.

iv. Both lungs were extremely congested and oedematous, but no massive collapse or large areas of collapse were noted.

v. No signs of inflammatory reaction were observed in the bronchial mucosa in contact with the swab. No microscopic examinations of the trachea or bronchi were made.

The Inquest

An Inquest was held, the focal point of which was the origin of the gauze swab and the part it may have played as a cause of death. In his evidence, the medical practitioner who conducted the autopsy expressed the view that the swab could not have remained in the air passages for 12 days without causing symptoms of respiratory obstruction, and without leaving post-mortem evidence in the way of collapse of the lung and a clear inflammatory reaction in the mucosa of the trachea or bronchus. He was therefore of the view that the swab had not been left by the surgeon when the tracheotomy was performed. He also inferred that the swab must have been introduced into the trachea shortly before death, and that the most likely way in which it got there was through accidental introduction by the nursing staff during the cleaning of the wound and the tracheotomy tube. His opinion was, however, that the patient would have died from his head injury in any event, even if the swab had never obstructed the bronchus.

After further evidence about the accident and the operation performed on the head, the following verdict was returned by the presiding magistrate:

'Death due to extensive cerebral laceration and terminal asphyxia due to inhalation of a surgical swab during cleaning of the tracheotomy tube by one of the nursing staff. No blame is attributable to anyone.'

Further Investigations

In spite of the closing remark of the verdict, further investigation was ordered, and further evidence was taken under oath, to examine the possibility of negligence by the nursing staff.

The nursing sister in charge of the ward in which the patient had died described the technique used for cleaning tracheotomy wounds and tubes. She also stated that swabs such as that found in the bronchus of the deceased were not used for tracheotomy toilet, but that similar swabs were used by her nurses to plug tracheotomy openings during the procedure of laying out the dead body of a patient who had previously had a tracheotomy operation.

In view of this evidence, the Medical Superintendent of the hospital postulated that the offending swab was placed in the tracheotomy opening by a member of the nursing staff during the process of laying out the body *after* death. He suggested that it was then somehow sucked into the bronchus

by movement of the chest during transportation of the body to the hospital mortuary and, subsequently, to the Police Mortuary.

Experiments were carried out to test this hypothesis.

Experimental Investigations

Swabs were prepared from wide-mesh surgical gauze to the size and shape of that found in the bronchus of the deceased. They were then moistened and placed in the tracheae of adult dead bodies in which tracheotomy incisions were made just before autopsy.

Experiment 1. After placing the swab through the tracheotomy opening into the trachea so that only its upper end was visible in the wound, vigorous manual compression was applied to both sides of the chest 30 times.

During this procedure the upper end of the swab moved up and down through about half an inch at each compression. At the end of the experiment, however, the swab was in its original position.

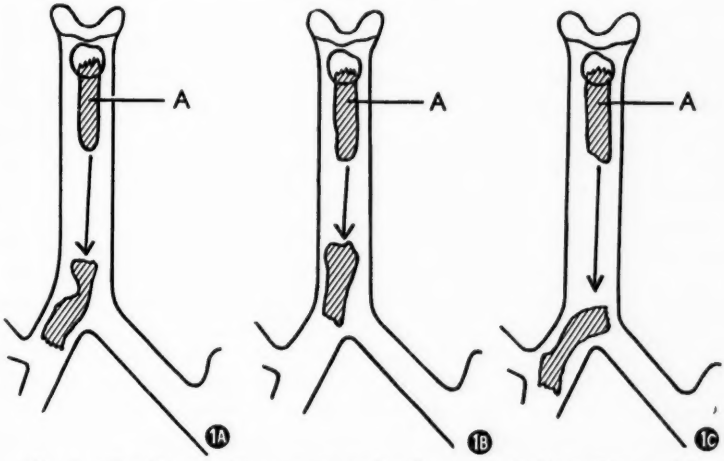

Fig. 1. The diagrams illustrate the trachea from the cricoid cartilage to the bifurcation.
The circle indicates the position of the opening made in the trachea in Experiment 2.
'A' is the position in which the swab was placed. The arrow shows where it was found in the 3 cases after removal of the thoracic organs.

This experiment was done on 3 bodies with the same result in each case. In one case the post-mortem interval was less than 2 hours, and the absence of rigor mortis permitted the thoracic compression to be carried out with the body in a sitting position. This made no difference to the final position of the swab.

Experiment 2. The swab was placed in the trachea of each of 3 dead bodies as in the first experiment. The thoracic organs were then removed by a commonly used technique. After the tongue, larynx and upper oesophagus had been freed, downward traction was exerted upon them, pulling these organs and the thoracic organs from the chest cavity *en masse*. The oesophagus, the inferior vena cava and the aorta were severed above the diaphragm, and the cervical and thoracic organs were then laid on a flat surface for dissection.

The trachea and the main bronchi were opened first, by cutting with scissors down their posterior surfaces.

The position in which the swab was found in each case is shown in Fig. 1.

The experiments in Cases 1 and 2 were carried out by the author alone. In the third case a colleague was asked to remove the thoracic organs. Whilst the tracheotomy opening was, of course, obvious to him, he was unaware that a swab lay in the upper part of the trachea.

Comment

The experiments showed that it is unlikely that movements of the thorax (such as might have occurred during transportation of the body) materially altered the position of the swab in the trachea. They also show, however, that the position of the swab may well have been altered during removal of the thoracic organs. It was later established that the organs were, in fact, removed by this technique in the case described.

This case emphasizes the importance of opening the larynx, the trachea and the main bronchi *in situ*, before removal of the thoracic organs, when conducting autopsies of medico-legal importance. If this is not done, doubt must be cast on any inferences drawn concerning foreign bodies which are later found in the lower trachea or the main bronchi.

I wish to thank the Secretary for Health for permission to submit this case report for publication.

The Electrophysiology of Homicide

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All living organs produce electrical currents. The human brain produces electrical currents which are quite characteristic. Berger, in 1928, began the first serious studies of brain currents. He discovered many interesting facts about brain waves. The brain-at-rest wave was termed the alpha rhythm. Its rhythmical beat occurs at the rate of 8–13 per second, usually about 10 in most persons. Its intensity varies in different subjects between 20 and 78 millionths of a volt, normally averaging about 50.

A second normal rhythm of somewhat lower intensity and faster, ranging between 18 and 50 per second, Berger called the beta rhythm. Frequently it is found in high-strung persons and seldom disappears during thought. Quite often the alpha and beta rhythms occur together.

The electrical recording of brain activity affords a valuable clue of the functions of the brain in normal and abnormal states. The electroencephalogram is a graphic record of the inner activity of the brain, and a valid signature of its physiological state. It can tell us a great deal about the emotional state of the individual.

The dysrhythmic brain, resulting in disordered or criminal behavior, has been found to have quite characteristic and distinctive electroencephalograms. D. Stafford-Clark and F. H. Taylor (*Clinical and Electroencephalographic Studies on Prisoners Charged with Murder,* J. Neurol, Neursosurg. Psychiat., **12,** 325–330, November 1949) suggest from a study of the literature that a significantly increased tendency for electroencephalographic abnormality occurs in subjects whose behavior has brought them consistently into collision with society.

They studied the EEG of 64 prisoners facing charges of murder. They obtained full personal and family histories, together with details of the charge and trial proceedings, and examination of the mental state. Stafford-Clark and Taylor placed the prisoners in one of 5 groups, depending on clinical assessment:

1. Eleven cases in which the killing had been incidental to the commission of another crime or had been in self defense.
2. Sixteen cases have a clear motive for killing or in which death followed extended violence during the commission of another crime.
3. Fifteen cases in which the crime was apparently motiveless or the motive had been very slight.
4. Eight persons charged with murders in which there was a strong sexual element.
5. Fourteen persons found unfit to plead, or guilty, but later judged as insane.

Electroencephalograms were grouped as:

1. normal; 2. mild, unspecific abnormal; 3. severe unspecific abnormal; 4. specific, focal or epileptic abnormal. Stafford-Clark and Taylor found that a significant correlation exists between apparently motiveless crimes and EEG abnormality. Such abnormality, though not specific, appeared in over 70% of prisoners whose crimes appeared motiveless but who otherwise were clinically sane and normal. Groups 3 and 5 showed a marked preponderance of abnormal records (73% and 86% respectively). However, in group 5 there were 5 epileptics. Groups 1 and 2 showed a preponderance of normal over abnormal EEGs. Only one subject in group 1 had an abnormal record. Four of group 2 had an abnormal record. Two of these were specific in character, one patient having a history of head injury and the other traumatic epilepsy. The other two had mildly abnormal unspecific EEGs and each had very poor motives for murder. The 8 cases in group 4 divided equally between normal and abnormal records.

It is believed that the EEG may prove helpful in the investigation of criminals. The unsatisfactory nature of psychiatric criteria commonly admissible in criminal justice to assess an individual's culpability is well known. With the EEG there is a possibility that an objective indication of innate propensities affecting responsibility may obtain. It is, moreover, an indication likely to be of maximal value in precisely those cases where clinical observation and the operation of reason are least able to elucidate the basis of the individual's actions. It seems unlikely that correlation between apparently motiveless violence and an abnormal EEG is purely coincidental.

More recently, E. D. Schwade and Sara G. Geiger (*Abnormal Electroencephalographic Findings in Severe Behavior Disorders,* Diseases of the Nervous System, **17,** No. 10, October 1956) have found that abnormal behavior results in quite characteristic and distinctive brain tracings.

It is well known that impulsive behavior which becomes compulsive after an exciting factor has released the emotions has been noted over the years. This possibly is the behavior described legally as the irresistible impulse, an acting out behavior which is beyond the ability of the individual to control.

Schwade and Geiger studied 623 such cases over a period of 10 years, and found that 453 showed a consistent brain wave tracing of 6 and 14 cycles per second (c.p.s.) positive spiking. Factors responsible for 6 or 14 per second positive spiking or 6 and 14 per second positive spiking are not definite, but may have origin in traumatic, toxic or hereditary conditions with damage to the thalamus, hypothalamus or possibly the amygdala, or to all areas. It is germane that this electroencephalographic abnormality is rarely seen beyond 18 years of age. The personality overlay may be apparently normal or pathologic, but the potential for acting out is always there, being released by emotionally traumatic situations.

Schwade and Geiger believe that clinically there are disorders of the brain which have a characteristic dysrhythmia which should not be classified with clinical epilepsy. In their group of 623 individuals there were 5 bizarre impulsive-compulsive murders. It is possible that disorganized thalamic, hypothalamic or possibly amygdalic impulses are released by a trigger-like stimulus, and acted out without cortical control.

An organic brain defect may be present, but unless sparked by deep emotional disturbances the person does not present outstanding problems or become a menace in the community. Many undetected cases undoubtedly exist where emotional development has been so normal and stresses so limited that this reaction has not been released. The pathologic behavior is usually directed externally and rarely against self. Insight can be developed and may become protective of basic ego safety although, in defense or for revenge, the earlier types of violent reactions may break through.

The conclusions reached by Schwade and Geiger from these studies is that in every child or adult who has pathology in the thalamus, hypothalamus, or possibly the amygdala, there is a potential for violently destructive behavior. This behavior occurs under extreme emotional stress when there is a serious threat to the integration of the personality. Youthful crime and murder are not so likely to be anticipated when the presence of 6 and 14 per second positive spiking is known.

A. C. Mundy-Castle (*The EEG in 22 Cases of Murder or Attempted Murder,* Journal of the National Institute for Personnel Research, **6,** 103–120, March 1956) reported on EEG studies of 22 subjects, 15 Africans and 7 Europeans, involved in 20 murders and 2 attempted murders. Four subjects were found mentally disordered or defective before arraignment, and 12 on arraignment. Three were found guilty but insane, and one committed his crime while in a mental hospital. These subjects committed their crimes without a motive or with only a slight motive, or were motivated by irrational ideas. Of the remaining 2 subjects, one attempted a murder under extreme provocation, and one killed in self defense.

Electroencephalograms were classified as normal or abnormal, the latter being graded into 3 categories: A1: mild, nonspecific abnormalities; A2: severe, nonspecific abnormalities; and A3: focal and epileptic abnormalities. EEG components were classified as delta rhythm (0.5–3% c.p.s.), theta (4–7 c.p.s.), alpha (8–13 c.p.s., occipital or parieto-occipital origin), alphoid (8–13) c.p.s. frontal or fronto-temporal origin), beta (14–30 c.p.s.), and slow alpha variants (2nd subharmonic of the alpha rhythm, of the same origin).

It was found that 6 subjects were confirmed epileptics. Sixteen had abnormal EEGs. Of these, 2 were in the A3 category, one in the A2 category, and 3 in the A1 category. Six showed unilateral temporal lobe foci, and 10, including 4 with temporal lobe foci showed epileptic

phenomena. In addition, 11 subjects had abnormal theta rhythms, and 5 showed slow alpha variants, 3 as traces and 2 clear.

Apart from these slow alpha variant abnormalities, 3 cases were striking for harmonic relationships often present in the analysis of their EEG abnormalities. It was noted that frontal or fronto-central alphoid activity seemed fairly common in this group, and analysis revealed that 14 showed this kind of activity, 5 of these sometimes in anterior or generalized paroxysmal burst form. These alphoid rhythms were spatially and temporally independent of the alpha rhythms. No striking changes were noted as a result of hyperventilation. In 20 cases given flicker, existing abnormalities were augmented in 3 cases, and abnormalities were evoked in a further 2 cases.

This study is in direct support of previous studies showing that, as a group, murderers who are psychotic, or whose crimes are unmotivated, show an unusually high incidence of both EEG abnormality and epilepsy. This study points in particular to the temporal lobe as of importance in aggressive behavior. A number of problems are raised by the high incidence (65%) of anterior alphoid rhythms found in this group. This activity has previously been reported as common among normal Africans, but its incidence in this group of Africans is greater than in normals. The significance of this activity is not certain, but there are indiciations that it is related both to emotional instability and to racial or cultural differences.

The electroencephalogram is a written record of brain activity. The record is normal in normal states of brain activity and abnormal in abnormal states of brain activity, of which murder is one of quite a few.

Russell Brain, the distinguished neurologist, has used the following graphic description of brain-mind relationship:

> 'Not only are there twelve thousand million nerve cells out of which the patterns can be made, but nervous patterns exist in time, like a melody, as well as in space. If you look at a tapestry through a magnifying glass you will see the individual threads but not the patterns. If you stand away from it you will see the pattern but not the threads. My guess is that in the nervous system we are looking at the threads, while in the mind we see the patterns, and that one day we shall discover how the patterns are made of the threads.'

The mechanism of memory, habit formation, thinking and behavior are based on nerve pathways and synaptic connexions within the brain. It is the streaming of impulses in a complex series of circuits that makes mind feasible. Many of these circuits pass from cortex to thalamus and brain stem and back. Probably these are the circuits most important for mental functions; but because it is the working together and the sequence in time that matter, no one part is higher or lower than the others. Some are concerned largely with alertness and awareness; others with discrimination and choice. The circuits concerned with discrimination and choice may be the ones that play an important role in criminal behavior. When we are able to isolate and understand what these are we may well be on the way to a meaningful understanding of the neurology of crime.

Estimation of Arsenic in Biological Tissue

By Activation Analysis

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Summary

The non-destructive determination of arsenic in single hairs is described. Qualitative and quantitative physical measuring techniques are applied to hairs after activation by thermal neutrons. The quantitative methods are of limited accuracy (10%) and are generally used only when it is necessary to retain the sample for further investigation. The qualitative methods are useful when arsenic contaminated samples are being investigated but not for normal samples. A successful attempt is made to discover if the intake of arsenic can be timed by determining the position of contamination along the hair. In general the methods are regarded as aids to give previous knowledge of the trace element content of the tissue. In use all phenomena must be checked to see that they are in fact due to arsenic.

In the close investigation of hair for arsenic the total arsenic content is important as this shows the presence of arsenic and whether or not it is in normal concentrations. If abnormal amounts are found it is necessary to know whether the exposure was over a long period or all at once and if possible to discover at what time the exposure took place. Often the amount of hair available is very small or required for other purposes so the minimum sample must be used. With these problems in mind the following non-destructive investigation of the arsenic content of single hairs was made.

Qualitative Analysis

When a hair is placed in a flux of thermal neutrons the stable elements in the hair may be rendered artificially radioactive. The activity is due to the trace elements (mostly sodium) and not to the organic material of which the hair is composed. This means that any variation in the excretion of one of the trace elements would result in a variation in the activity of a section of the irradiated hair. If a normal hair, that is one in which the trace element distribution is uniform, is activated and the activity, as

measured by a Geiger counter, is plotted against the distance from the bulb it is possible to obtain a graph which is approximately linear. If the hair is abnormal, that is one in which the trace element distribution varies appreciably from normal, the graph is broken by a peak or a trough. The troughs are small being due, generally, to the variation in sodium excretion. The peaks may be large and are due to the appearance in the hair of trace elements not usually there in any great quantity. Arsenic is such an element and is the subject of this investigation. In work similar to this using bundles of hair (2) attempts apparently successful have been made to tell the time at which the arsenic was administered by calculating the distance from the bulb at which the peak due to the increased arsenic content occurred. The identity of the arsenic in all cases must be proved by half-life measurements, γ-spectrometry or activation analysis with full chemical separation (3).

Method

In order to discover whether it was possible to find peaks due to increased arsenic content it was decided to use two methods as described below.

Samples Used

Normal Hair: This was hair obtained from a subject who had no known exposure to arsenic. A normal hair contains some arsenic in traces, but as it is evenly distributed it does not interfere with the relative smoothness of the activity graph of the hair after irradiation.

Contaminated Hair: This was hair in which arsenic was deposited by internal administration. The concentration reached in the section of the hair concerned was about 36 p.p.m. (parts per million). A volunteer had taken 5 minims liquor arsenicalis (1) four months before removal of the hair.

Artificially Contaminated Hair: This was normal hair as above, but a section of it had been soaked in a solution of arsenic. On analysis it was found that the local concentration of arsenic was in some cases about 300 p.p.m. During this investigation it was found that 1 mgm. of hair would absorb approximately 0.27 μg of arsenic from a solution of 10 μg of arsenic/ml.

Estimation by Counting Sections Along the Hair

The hair was irradiated for 24 hours in a thermal neutron flux of 10^{12} neutrons/cm.^{2}/sec. and on return from the pile fixed by means of self adhesive tape to a piece of graph paper. It was then cut into 5 mm. lengths suitable for counting by an end window Geiger counter. The results were plotted on a graph against distance from the bulb of the hair.

Results

Fig. 1 shows the graph obtained from a normal hair. It will be noticed that the activity decreases towards the end of the hair causing the graph to slope towards the axis. This is due to the reduction in the mass of

the hair towards the end and to the decay during the period of measurement. There is also a large activity at the bulb due to the materials clinging to it when removed from the head. These phenomena were shown by all the hairs tested. The mean variation in activity as taken from the straight line (Fig. 1) was about 20% neglecting the bulb. When contaminated hair was examined the graph obtained was as shown in Fig. 2. This showed a small peak at 6 cms. from the bulb. The calculated growth rate was 15 mm./month so the peak was in the correct position. Repeating this experiment with five different hair samples gave results which confirm the accuracy of the method as shown in Table 1.

Table 1

Known Time of Exposure	*Calculated Time of Exposure*
4 months	4 months
3 months	3 months
2 months	2 months
1 month	1 month
3 weeks	¾ month
2 weeks	½ month

The accuracy is limited by the length of the sample taken (0.5 cms. is equivalent to about 9 days' growth) and the constancy of the growth rate.

The deviation of the peak height from the mean was found to be about 50%—appreciably greater than for normal hair. Activation analysis (3) gave the arsenic content of the peak area as 36 p.p.m. and the rest of the hair as 0.89 p.p.m. Taking double the normal deviation as the minimum distinguishable as a definite peak, the sensitivity is limited to peak concentration not much lower than 30 p.p.m.

Conclusion. The method can be used on a single hair to determine areas of high arsenic concentration and to determine approximately when the arsenic which caused this concentration was taken. It is necessary in the case of any such peak being observed to prove that the activity is in fact due to arsenic-76.

Autoradiography

Autoradiography is a technique whereby a substance which emits radiation produces an image of itself on a photographic emulsion. The closer the contact between the emulsion and the active sample the more definite is the resulting radiograph. This work deals with a simple qualitative method so the special techniques and emulsions necessary for the production of the sharpest images have not been used. Several emulsions were tried but the most useful was "Kodirex" X-ray type, other photographic emulsions being rather insensitive. The exposure used with this film was about 16 hours.

Method

The active hair was placed on a strip of self adhesive tape which was then fixed as closely as possible to the emulsion. If the tape was not fixed down properely the clearness and value of the autoradiograph was lost. The tape and hair were removed after exposure was complete by pulling from the emulsion under water in order to prevent fogging by static electricity. The film was developed in an X-ray type developer and measurements made at intervals along the image. These were then plotted on a graph against distance from the bulb. Three techniques for measuring the activity of the hair from the autoradiographs were used.

1. The measurement of the relative optical density of the image by means of a densitometer.

2. The measurement of the width of fogging of the image by a microscope with a superimposed scale. It was often found difficult to establish the border of fogging exactly, so the width between the areas of most rapid change of emulsion density was chosen.

3. High contrast prints were made of the autoradiograph and the width of the resulting very sharp image was measured.

Results. When the graphs of the activity against distance from the bulb were plotted it was found that those from the different measuring techniques corresponded reasonably well with each other though the prints tended to lose the small details.

It was found when the normal hair graph was plotted that a deviation of about 90% from the mean was shown (Fig. 3). Six more hairs were examined and all gave similar results. When the contaminated hairs (peak with value of 36 p.p.m.) were examined it was found that no variation which would distinguish it from normal hair could be found. The method therefore is not sensitive to arsenic concentrations of 36 p.p.m. Artificially contaminated hairs showed definite peaks in all the measuring techniques, and over a range of 100-300 p.p.m. gave a deviation in the order of 200% per 100 p.p.m. To be apparent against the background variation of a normal hair the minimum arsenic content must be over 50 p.p.m.

Conclusion. Autoradiography will show the presence of very large concentrations of arsenic but it is less sensitive than the counting technique described above, so the latter is to be preferred unless it is necessary to keep the hair whole. The identity of the arsenic in any peaks should be proved by one of the usual methods.

Quantitative Analysis

It was found that most of the activity of a radioactive hair is due to sodium-24 and arsenic-76 if the latter is present in greater than normal amounts. This is not so immediately after irradiation as there is short-lived activity present but is true after allowing the sample to decay for about 2 days. Allowing this time lapse it is possible in some cases to make a quantitative estimate of the arsenic present using the following methods.

It is necessary in these methods to establish the identity of the arsenic and show by the usual methods that no other long-lived isotope is interfering.

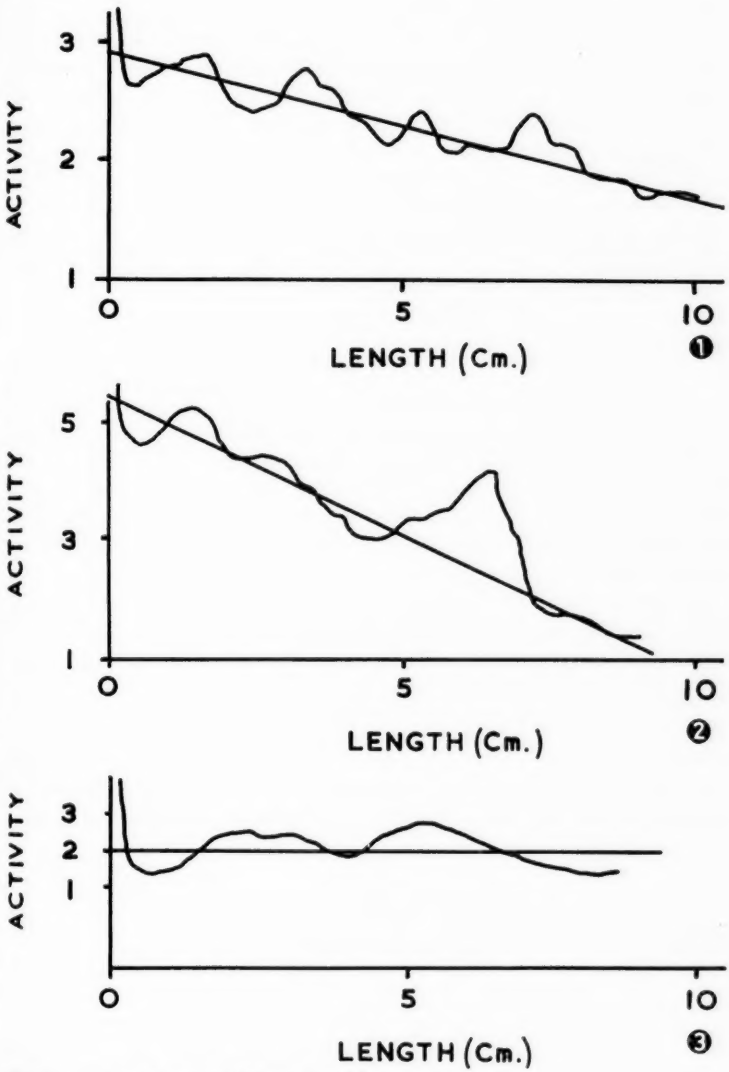

Fig. 1. Activity of normal hair as found by counting sections.
Fig. 2. Activity of contaminated hair as found by counting sections.
Fig. 3. Activity of normal hair as found by autoradiography.

Solid Filter Method

The property under consideration was that of absorption of the radiation from active sources when passing through a solid body. Using an end window Geiger counter the transmission values for the radiation from Arsenic-76 and Sodium-24 through varying thicknesses of solid aluminium were obtained. Graphs of transmission against thickness (mgm./cm^2) were plotted for the two isotopes and compared. The greatest separation of the graphs occurred in the 100-200 mgm./cm.^{2} region, so for these two values the transmission was accurately determined. It was found that for the 100 mgm./cm.^{2} filter, 0.700 of the arsenic-76 radiation and 0.392 of the sodium radiation was transmitted, and for the 200 mgm./cm.^{2} filter the values were 0.475 and 0.143 respectively. On this basis simultaneous equations of the following form were constructed.

$$0.700a + 0.392b = x$$
$$0.475a + 0.143b = y$$

where a is the count rate due to arsenic − 76
b is the count rate due to sodium − 24
x is the count rate with 100 mgm/cm^2 filter
y is the count rate with 200 mgm/cm^2 filter

The solution of this equation gives the count rate for the arsenic and the sodium, which on addition may be compared with the count rate without filter to give a check on the calculation. The count rate of the arsenic in the sample may be compared with a standard sample to find the absolute arsenic content.

Half-Life Method

The property under consideration was the different half-lives of arsenic-76 and sodium-24. The half-lives should be of such values that a good separation of the plotted curves can be obtained in a reasonable time and this is true of arsenic and sodium. From the decay curves it is possible to find the decay factors at any given time (the values may be calculated if preferred) and from these to construct equations of the following form.

$$a + b = x$$
$$pa + qb = y$$

where a is the count rate due to arsenic − 76
b is the count rate due to sodium − 24
x is the count rate at time = 0
y is the count rate at time = t
p is the decay factor of arsenic-76 at time = t
q is the decay factor of sodium-24 at time = t
t is the time between first and second count rate determinations and is usually 1 or 3 days

Solution of the equation gives the count rate due to the arsenic and this may be changed to the absolute arsenic content by comparison with a standard.

Example. A sample of hair which had a high arsenic content was activated and analysed by the two methods giving the following results.

Total count rate of sample (after 2 days)	4474 c/m
Count rate with 100 mgm/cm^2 filter	2701 c/m
Count rate with 200 mgm/cm^2 filter	1686 c/m
Count rate after 70 hours	672 c/m

By method 1 above the activities obtained were—

Sodium – 24	1194 c/m
Arsenic – 76	3190 c/m

By method 2 above the activities obtained were—

Sodium – 24	1344 c/m
Arsenic – 76	3130 c/m

The values obtained for the arsenic were compared with a standard and hence the absolute content obtained.

The same hair was analysed by the activation/chemical analysis method (3) and a value of 329 p.p.m. was obtained which was 5% less than that obtained from the experiments above.

Results. Twelve samples ranging in value from 60-329 p.p.m. were analysed by the above methods and a variation of 5-15% from the correct value was obtained. It was estimated that the lowest value which could be estimated in the presence of the normal background would be 20 p.p.m. The higher the arsenic content is the more accurate the estimation becomes.

Conclusion. Non-destructive activation methods for determining arsenic in hair prove useful in quantitative and qualitative analysis when relatively large amounts are present. The time at which any large dose of arsenic has been ingested may be approximately established by calculations based on the distance, of the area of high arsenic contamination, from the root. In all uses of these methods it is necessary to prove by one of the normal methods that the isotope being dealt with is in fact arsenic-76. It should be noted that these methods are essentially only aids in the investigation and that the use of activation analysis with chemical separation is usually necessary.

The author thanks John Glaister, J. M. A. Lenihan and Edgar Rentoul for advice given during this investigation.

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Specificity in Blood Grouping with Plant Lectins

And the Application of N-Lectin to Dry Blood Stains*

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The availability of various plant extracts which exhibit blood group specificity has led to recent advances in grouping of dry blood stains, and the determination of numerous genotypes of human blood in the ABO system.[1, 2] Both specific and non-specific effects are found with these materials, variable as between different plant species. The procedures by which the lectins could be used so as to be specific were given, but the quantitative aspects were not developed fully.

While the M and N factors of human blood have long been determined to a limited extent for criminalistic purposes, it is recognized that the detection of N antigen in dry blood is difficult and often completely uncertain. On the contrary, the M antigen may be detected readily in both fresh and dry blood by means of anti-M sera which are commercially available. Determination of M alone has only limited value, inasmuch as the sum of M and MN individuals who react positively totals close to 80% of the population.

Because it is desirable to have a reliable method for detection of N as well as M antigen, a study of lectins for these factors was carried out. Only the N lectin proved to have advantage over serum for the purpose of grouping. Its agglutinating ability was studied quantitatively, as well as that of the H, O, A_2 and A_1 lectins previously studied.

Experimental

Antisera. Only the antisera for M and N were employed in the present work. Tests of 100 samples of fresh blood, obtained from the California State Department of Public Health, showed no instance in which doubt about the presence or absence of the M antigen existed, when tested with antiserum. In about one of 5 samples it was difficult or impossible to be certain of the presence of the N antigen when tested similarly. Indirect grouping of dry blood stains showed similar results: there was no doubt of the results with M, but difficulty when anti-N sera were employed.

All 100 bloods tested were grouped directly with antisera for both M and N. The results served as controls for the tests of lectin which followed.

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† All commercial lectins were obtained from Hyland Laboratories, Los Angeles, California.

Lectins. The lectins employed were commercial samples† of A_1, A_2 H, O, M and N. Trials of M lectin (from *Iberis amara*) showed the available material to be of little value as compared with anti-M serum, and its use was soon discontinued. Quantitative comparison of the specific and non-specific effects of the other lectins was made with the result that a reliable technique for the use of N lectin (from *Vicia graminae*) in grouping of dry blood spots was developed. This material showed a low degree of specificity as well as great lability. Some lots required full strength material and 15 minutes on the Eberbach Rotator to agglutinate N cells, and would agglutinate M cells in 25 minutes under the same conditions. Dilution of the lectin greatly reduced the non-specific activity. In adsorption grouping of dry blood, the non-specific activity was found generally to be adsorbed out during the adsorption period.

Some lots of the N lectin were so weak that dilution was not possible. Others which required dilution for indirect grouping had to be diluted with 5% bovine albumin or human AB serum. Saline solution as a diluent did not allow agglutination to occur.

Procedure for Specificity Tests. Each lectin tested was prepared in a series of dilutions. Appropriate cells were obtained, one set carrying the antigen in question and another set devoid of any specificity.

For the H-lectin, the cells were O, A_1B and A_2B;
For the O-lectin, the cells were O, A_1B and A_2B;
For the A_2-lectin the cells were A_2B and O;
For the A_1-lectin the cells were A_1O, O, BO and A_2O;
For the N-lectin they were MN and MM.
No tests were made with M-lectin because of its general unsatisfactory performance.

The lectin in its various dilutions was placed with the appropriate cells in the quantities previously described[1] and shaken for timed intervals on the Eberbach Rotator at 140 rotations per minute. At 5-minute intervals the agglutination plate carrying all mixtures was removed and examined, being replaced immediately for the next shaking interval. Agglutination was designated as + to ++++ as previously described,[1] which was essential to an approximate quantitative evaluation of the results.

Procedure for Indirect Grouping with N-Lectin. Dilutions of N-lectin were made 1:20, 1:40 and 1:80, using 5% bovine albumin as diluent. These solutions, along with the lectin, were tested against N cells and against M cells. To 20 microliters of the lectin solution were added 1 microliter samples of the respective red cells in 2% suspension. The mixture was rotated on the Eberbach Rotator (140 rotations per minute) for 15 minutes and examined for agglutination under the microscope. The mixture was returned to the rotator and examined each 5 minutes for a total rotation time of 40 minutes. The degree of agglutination was plotted against time for each titer. The graphs served as standards for N-specific and non-specific agglutination. The appropriate time and dilution could then be selected for indirect grouping.

The sample of dry blood was placed in a small tube and the appropriate dilution of N-lectin added in sufficient amount to just cover the sample. In this study, one hour was uniformly sufficient for total adsorption inasmuch as the samples, in no instance, had been dry for more than 10 days. Long periods of adsorption were found to be detrimental, although up to 24 hours allowed correct determination.

After adsorption, the supernatant dilute lectin solution was treated with N cells as described above. In theory, the adsorption should have removed the specific agglutinating ability, but not the non-specific. Such was not found to be the case, and in all instances the non-specific was adsorbed as much as or more than the

specific activity. Lack of agglutination in the proper time indicated specific adsorption and could be interpreted reliably.

Inhibition of agglutination is not an all-or-none phenomenon, and definite inhibition may be recognized even when a slight degree of agglutination exists. Using the criteria defined above, it was determined that inhibition was shown when agglutination designated as + or ++ was present. With +++ or ++++ it was considered that there was no inhibition. Naturally, this matter is controlled to a degree by the dilution or activity of the lectin used, and there is a certain degree of subjective judgment involved as well.

Results

Lectin Specificity. Except for A_1-lectin, the behavior of each lectin tested was generally similar to that of the others but with differences in some significant details. A_1-lectins showed no failure of specificity, although it was tested with O, BO and A_2O cells. The preparations used were always diluted, the volume ratios being from 1 : 40 to 1 : 320. The strongest lectin solution produced complete agglutination of A_1O cells in 15 minutes, the weakest in 30 minutes.

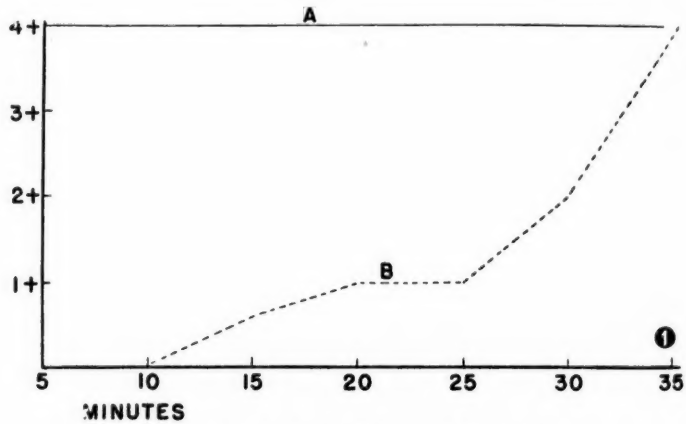

Fig 1. Agglutination by H-Lectin, full strength
A: O cells and A_2B cells.
B: A_1B cells.

The behavior of H-lectin is shown in Fig 1 at full strength with O, A_1B and A_2B cells. It will be noted that at any time between 5 and 10 minutes cells carrying either O or A_2 specificity were completely agglutinated, while those lacking these factors required 35 minutes for full agglutination, with none visible in 10 minutes. Similar results were obtained with dilutions of 1 : 40 and 1 : 80, except that the curves were moved sharply to the right, and agglutination of A_2B cells was weak at the lesser dilution, absent at the

greater up to 35 minutes of shaking. Complete agglutination of O cells was obtained in 25 minutes, at a dilution of the lectin of 1 : 80.

Results of a similar study of O-lectin are shown in Fig. 2. Five minutes produced complete agglutination of O-cells with full strength material. After this time, A_2B cells commenced to agglutinate, but did not exceed ++ in 35 minutes. A_1B cells were not agglutinated detectably in 35

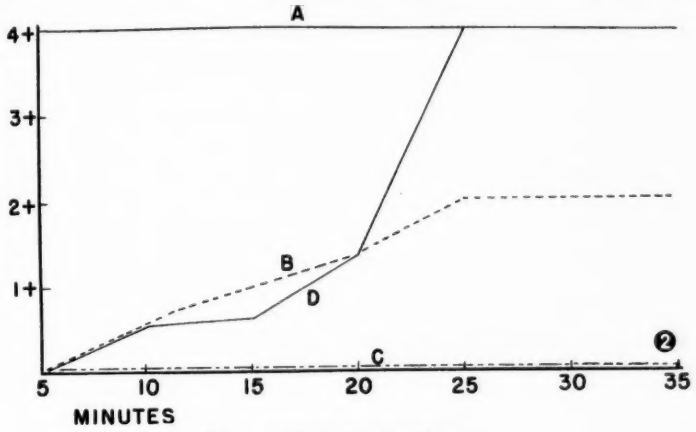

Fig. 2. Agglutination by O-Lectin.
A: O cells, full strength lectin.
B: A_2B cells, full strength lectin.
C: A_1B cells, full strength lectin.
D: O cells, 1:20 lectin.

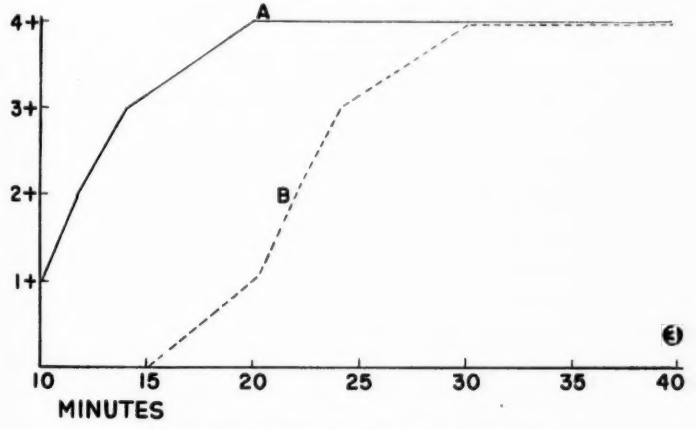

Fig. 3. Agglutination by A_2 Lectin, full strength.
A: A_2B cells.
B: O cells.

minutes. A 1 : 20 dilution of the O-lectin preparation produced full agglutination of O-cells only after 25 minutes, and did not agglutinate either A_1B or A_2B cells detectably in 35 minutes.

Fig. 3 shows the corresponding behavior of A_2 lectin used full strength with A_2B and O cells. At 15 minutes the agglutination of A_2B cells is approaching completion, whereas that of O cells is just beginning to occur. This time represented that at which no difficulty of specificity would be encountered with this preparation. Both types of cell were fully agglutinated at 30 minutes.

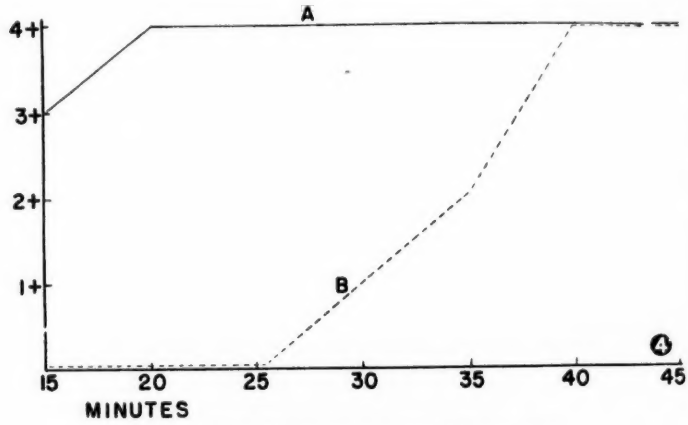

Fig. 4. Agglutination by N-Lectin, full strength.
A: MN cells.
B: MM cells.

The properties relating to specificity of N-lectin are shown in Fig. 4 when tested with MN and MM cells, respectively. With one batch of N-lectin at 1 : 20 dilution, 15 minutes produced complete agglutination of MN cells but none of MM. After 30 minutes, both types of cell were completely agglutinated. At the rather high dilution of 1 : 80 agglutination of MN cells was somewhat less than complete, but strong at 30 minutes, while MM cells remained completely nonagglutinated in this time. At 45 minutes, agglutination was rather strong with both, complete with neither, and just distinguishable between the two.

Consideration of the data shown in Figs. 1–4 indicates that proper titration of the lectins before use, to correct for batch, age or other differences, will allow any lectin grouping within the list studied to be performed with complete specificity. A_1 lectin requires only that a satisfactory working dilution be established, since it appears to be completely specific. Data for M-lectin are not given because the behavior of this

Table 1: Results of Direct and Indirect Grouping

	Direct			*Indirect*			
No.	*M*	*N*	*Genotype*	*Anti-M Serum* (10 *minutes*)	*N-Lectin* (15 *minutes*)	*Genotype*	*Age-Dry Days*
1.	+	+	MN	– (no agg.)	– (no agg.)	MN	2
2.	+	–	MM	–	++++	MM	2
3.	+	+	MN	–	–	MN	2
4.	+	–	MM	–	++++	MM	2
5.	–	+	NN	+++	–	NN	2
6.	+	+	MN	+	+	MN	2
7.	+	+	MN	–	++	MN	2
8.	–	+	NN	+++	–	NN	2
9.	+	–	MM	–	++++	MM	2
10.	+	+	MN	–	–	MN	2
11.	+	+	MN	–	+	MN	10
12.	+	+	MN	–	++	MN	10
13.	+	–	MM	–	+	MN*	10
14.	+	–	MM	–	++++	MM	10
15.	+	–	MM	–	++++	MM	10
16.	–	+	NN	+++	–	NN	10
17.	+	–	MM	–	++++	MM	10
18.	+	+	MN	–	+	MN	10
19.	–	+	NN	+++	–	NN	10
20.	+	+	MN	–	+	MN	10
21.	+	+	MN	–	–	MN	10
22.	+	–	MM	–	+	MN*	10
23.	+	+	MN	–	–	MN	10
24.	+	+	MN	–	–	MN	10
25.	–	+	NN	+++	–	NN	10
26.	+	–	MM	–	++++	MM	5
27.	+	–	MM	–	++++	MM	5
28.	+	+	MN	–	+	MN	5

*N factor detected only by indirect method.

Table 1: Results of Direct and Indirect Grouping (*Continued*)

Direct				*Indirect*			
No.	*M*	*N*	*Genotype*	*Anti-M Serum (10 minutes)*	*N-Lectin (15 minutes)*	*Genotype*	*Age-Dry Days*
29.	+	+	MN	–	–	MN	5
30.	–	+	NN	+++	–	NN	5
31.	+	+	MN	–	–	MN	5
32.	–	+	NN	+++	–	NN	5
33.	+	–	MM	–	+++	MM	5
34.	+	+	MN	–	–	MN	5
35.	+	–	MM	–	+++	MM	5
36.	+	+	MN	–	–	MN	6
37.	–	+	NN	+++	–	NN	6
38.	–	+	NN	+++	–	NN	6
39.	+	–	MM	–	+++	MM	6
40.	+	+**	MN	–	–	MN	6
41.	+	+	MN	–	–	MN	6
42.	+	+	MN	–	–	MN	6
43.	+	+	MN	–	–	MN	6
44.	–	+	MN	+++	–	NN	6
45.	+	+	MN	–	–	MN	6
46.	+	–	MM	–	++++	MM	6
47.	+	–	MM	–	++++	MM	6
48.	+	–	MM	–	++++	MM	6
49.	+	–	MM	–	++++	MM	6
50.	+	+	MN	–	–	MN	6
51.	+	–	MM	–	++++	MM	8
52.	–	+	NN	++++	–	NN	8
53.	+	–	MM	–	++++	MM	8
54.	+	–	MM	–	++++	MM	8
55.	+	–	MM	–	++++	MM	8
56.	–	+	NN	++++	–	NN	8

**Very weak reaction.

Table 1: Results of Direct and Indirect Grouping (*Continued*)

Direct				*Indirect*			
No.	*M*	*N*	*Genotype*	*Anti-M Serum* (10 *minutes*)	*N-Lectin* (15 *minutes*)	*Genotype*	*Age-Dry Days*
57.	+	+	MN	−	−	MN	8
58.	+	+	MN	−	−	MN	8
59.	+	−	MM	−	++++	MM	8
60.	−	+	NN	++++	−	NN	8
61.	+	+	MN	−	−	MN	8
62.	+	−	MM	−	++++	MM	8
63.	+	+	MN	−	−	MN	8
64.	+	+	MN	−	++	MN	8
65.	+	+	MN	−	−	MN	8
66.	+	+	MN	−	−	MN	8
67.	+	+	MN	−	−	MN	8
68.	−	+	NN	++++	−	NN	8
69.	+	+	MN	−	−	MN	8
70.	+	−	MM	−	++++	MM	8
71.	+	+	MN	−	−	MN	8
72.	−	+	NN	++++	−	NN	8
73.	−	+	NN	++++	−	NN	8
74.	+	+	MN	−	−	MN	8
75.	+	+	MN	−	−	MN	8
76.	−	+	NN	+++	−	NN	6
77.	−	+	NN	++++	−	NN	6
78.	+	+	MN	−	−	MN	6
79.	+	−	MM	−	++++	MM	6
80.	+	−	MM	−	++++	MM	6
81.	+	+	MN	−	−	MN	6
82.	−	+	NN	++++	−	NN	6
83.	+	+	MN	−	−	MM	6
84.	−	+	NN	++++	−	NN	6
85.	+	−	MM	−	++++	MM	6

Table 1: Results of Direct and Indirect Grouping (*Continued*)

Direct				*Indirect*			
No.	*M*	*N*	*Genotype*	*Anti-M Serum* (10 *minutes*)	*N-Lectin* (15 *minutes*)	*Genotype*	*Age-Dry Days*
86.	–	+	NN	++++	–	NN	6
87.	–	+	NN	++++	–	NN	6
88.	–	+	NN	+++	–	NN	6
89.	+	+	MN	–	–	MN	6
90.	+	+	MN	–	–	MN	6
91.	–	+	NN	++++	–	NN	6
92.	+	–	MM	–	++++	MM	6
93.	+	+	MN	–	–	MN	6
94.	+	+	MN	–	–	MN	6
95.	+	–	MM	–	++++	MM	6
96.	+	–	MM	–	++++	MM	6
97.	–	+	NN	+++	–	NN	6
98.	+	+	MN	–	–	MN	6
99.	+	–	MM	–	++++	MM	6
100.	+	+	MN	–	–	MN	6

material was unsatisfactory with respect to strength, not specificity. Its action was so slow and uncertain as to preclude specificity study.

Dry Blood Stains. The N-lectin used in this study (numerous batches) was found to be readily and reliably applied to dry blood, by the adsorption or inhibition method. One hundred fresh blood samples were obtained as noted above, and grouped directly with anti-M and anti-N sera. A portion of each sample was dried on a glass plate and allowed to stand for a variable period of time up to 10 days before being grouped by the indirect method. The results of both groupings are detailed in Table 1. In 2 instances there was disagreement about the presence of N antigen. In both, the lectin used in the indirect method revealed a weak N which was not found in fresh blood with the anti-N serum. This is in line with the known difficulty of serum grouping for N.

The conventions of interpretation of data given above were followed.

It was of interest to compare the results of Table 1, statistically, with results obtained by other workers. The comparison is shown in Table 2.

Considering the relatively small sample used in this study, it is considered that the agreement is satisfactory.

Table 2: Incidence of M and N Factors

	Kabat[3]*	*Hyland*[4]†	*Present Study*
MN	50%	48%	44%
MM	28	31	31
NN	22	21	25

*Based on English population.
†Caucasians, U. S. A.

Summary

It is evident from the data presented that the plant lectins for blood group factors H, O, A_1, A_2 and N may be used in such a manner as to provide complete specificity. Only that for A_1 is inherently specific to a degree that it need not be calibrated for time of reaction with cells from corresponding and different blood groups. The difficulty of making such a time calibration is minimal, and well justifies the slight additional work in terms of the more significant results obtained, as compared with antisera.

As was earlier found to be true of the lectins for H, O, A_1 and A_2, the N-lectin is readily applied to adsorption grouping of dry blood. When used in conjunction with satisfactory anti-M serum, it is readily possible to determine the group of either fresh or dry blood in the MN system, as indicated by the study of 100 randomly selected blood samples.

References

1. Leister, Charles I., Jr. and Kirk, Paul L. (1961): *Purification of Plant Lectins by Continuous Electrophoresis, and their Application to Grouping of Dry Blood Stains.* J. Forensic Med., **8.** 42.
2. Leister, Charles I., Jr., Sylvia, Frederic R. and Kirk, Paul L. (1961): *Possible Application of Plant Lectins to Genotype Determination.* J. Forensic Med., **8.** 85.
3. Kabat, Elvin A. (1956): *Blood Group Substances: Their Chemistry and Immunochemistry.* New York: Academic Press, Inc.
4. *A Manual of Blood Grouping and Rh Typing Serums,* Hyland Laboratories, Los Angeles, 1956.

Notes and News

The Diploma in Medical Jurisprudence

Instituted by the Society of Apothecaries of London

Regulations for Admission to the Examination

1. Candidates must be registered by the General Medical Council and have possessed a qualification for at least three years to practise Medicine, Surgery and Midwifery in the United Kingdom.

Graduates in Medicine, Surgery and Midwifery, of British Commonwealth or Foreign Universities recognized by the Society, but whose degrees are not registrable in this country, may be admitted to the Examination by approval of the Court if they have complied with all other requirements of the Regulations.

2. Candidates must satisfy the Court of Examiners as to their suitability to enter for the Examination; and must produce official evidence of having had adequate practical experience.

Those wishing to enter for Pathology in Part II must submit evidence of having—

(*a*) satisfactorily completed at least three years' approved training in a recognised department of pathology;

(*b*) personally performed autopsies, including examples of the various forms of trauma and unnatural deaths.

3. The Primary Examination must be passed before admission to the Final Examination.

4. The Final Examination may be taken immediately after passing the Primary Examination or later.

5. The Examination will be written, oral and practical.

Primary Paper	Monday	10 a.m. to 1 p.m.
Final—Clinical:		
Paper 1	Monday	10 a.m. to 1 p.m.
Paper 2		2 p.m. to 5 p.m.
Pathology:		
Paper 1	Tuesday	10 a.m. to 1 p.m.
Paper 2		2 p.m. to 5 p.m.

The Oral and Practical sections will take place in the succeeding week.

6. The Examiners reserve the right to refer a candidate for one year, in either part, if deemed advisable.

7. The fee for the Primary Examination is eight guineas; for the Final Examination twelve guineas for each part, and a further fee of five guineas is payable for the Diploma. The re-examination fees are as above.

Syllabus

Part I (General)

The *Primary Examination* syllabus will include the following:

1. The History of Medical Jurisprudence. Structure and Principles of the British Legal Systems relevant to the practice of medicine. The Law of Evidence. Civil and Criminal Law Procedure. Duties and responsibilities of the Medical and Scientific Witness. Medico-legal systems in other countries.

2. The medical aspects of the law in relation to Offences against the Person, Infanticide, Poisons, Dangerous Drugs, Medical practice, National Health Service, Mental Health, Road Traffic and Factories; also in relation to the Registration of Births and Deaths, Cremation and Coroner's procedure, the protection of Children and Young Persons, Crimes of violence, Fatal accidents, Homicide, Suicide, National Insurance (Industrial Injuries), Workmen's compensation.

3. General procedure of enquiry into matters necessitating medico-legal investigation (clinical and pathological).

Methods of establishing the time of death; changes after death.

Methods of preserving evidence and writing reports.

Relations with Police and Coroner.

4. Medico-legal aspects of pregnancy and delivery; sexual offences.

5. Interpretation of wounds and injuries.

Recognition of poisoning, including intoxication by alcohol.

The pathology of unexpected death.

Part II (Clinical)

1. Examination and interpretation of medical and scientific findings in cases of common assault; sex assault; sexual deviation; nullity; divorce.

2. Examination and interpretation of wounds. Assessment and prognosis.

3. Examination and interpretation of findings in cases of unexpected or sudden death.

Grounds for suspicion; time of death; identification.

4. Psychiatry from the point of view of diagnosis and disposal.

Responsibility at law, including testamentary capacity; drug addiction; sexual deviation; suicide.

5. Clinical Toxicology—

i. Identification of common poisons.

ii. Symptoms and signs of poisoning; diagnosis; collection of material for analysis; interpretation of results; principles of treatment of poisoning.

6. Examination and assessment of cases of industrial accident and disease.

7. Examination and assessment of persons for life assurance.

8. Examination in cases of suspected drunkenness; differential diagnosis between drunkenness, the effects of drugs, certain diseases and the effects of head injuries; pharmacology of alcohol; principles of analysis for alcohols.

9. Interpretation of medical and scientific findings in cases of disputed paternity.

10. Medical statistics.

Part II (Pathology)

1. Post-mortem examination and medico-legal autopsy; examinations in the field; collection of trace evidence; methods of preservation of material; the use of photography.

2. The preparation and presentation of autopsy and laboratory reports.

3. Identification of human remains. (A knowledge of the use of scientific methods, including forensic odontology, will be required).

Methods of reconstruction.

4. Organization to be adopted in disasters involving multiple deaths (e.g. fire, rail and aircraft accidents).

5. Exhumation procedure.

6. Medico-legal aspects of the following specialities:

i. Paediatrics.

ii. Obstetrics.

iii. Neurology.

iv. Orthopaedics.

v. Traumatic and industrial respiratory affections.

vi. The cause of deaths associated with anaesthetic procedure and their investigation; modern techniques of anaesthesia.

Iatrogenic disease.

vii. The pathology of trauma; the relationship of trauma to disease.

viii. Toxicology—modern analytical methods; post-mortem appearances in cases of poisoning; relation with disease.

ix. Serology—technical procedures; application to disputed paternity.

Third International Conference on Alcohol and Road Traffic

Two International Congresses on Alcohol and Road Traffic have been held, the first in Stockholm in 1950 and the second in Toronto in 1953.

The Third International Conference on Alcohol and Road Traffic will be held at B.M.A. House, Tavistock Square, London, from Monday to Friday, 3-7 September 1962.

His Royal Highness the Duke of Edinburgh has graciously consented to be its Patron, and the President will be the British Minister of Transport.

An International Committee and a Committee of Management have been appointed with Prof. E. J. Wayne, Professor of the Practice of Medicine in the University of Glasgow, as Chairman of both Committees and Dr. J. D. J. Havard, Assistant Secretary of the British Medical Association, as their Secretary.

The following are some preliminary details:

Members of International Committee

Prof. G. C. Drew,
Department of Psychology,
University College, London U.K. *Deputy Chairman.*

H. Ward Smith, Esq., Ph.D.,
Director, Attorney-General's Laboratory,
Province of Ontario. Canada. *Assistant Secretary.*

David Archibald, Esq.,
Executive Director,
Alcoholism and Drug Addiction Research Foundation for Ontario.
Canada.

Prof. R. F. Borkenstein,
Chairman, Department of Police Administration, Indiana, U.S.A.

J. P. Economos, Esq.,
Director, Traffic Court Programme,
American Bar Association. U.S.A.

Prof. L. Goldberg,
Karolinska Institute, Stockholm. Sweden.

Members of Committee of Management

Deputy Chairman: Prof. G. C. Drew.

Medicine: Dr. F. E. Camps (*Forensic Pathologist*).
Dr. A. B. Davies (*General Practitioner*).
Dr. C. H. Johnson (*Police Surgeon*).
Prof. A. D. MacDonald (*Pharmacologist*).

Law: Prof. J. C. Smith (*University of Nottingham*).
Police: (One to be appointed).
Road Research: (One to be appointed).

Registration. The registration fee will be £7 sterling per person. Registration day will be Monday, 3 September 1962, at B.M.A. House.

Programme. The sessions will be arranged as follows:

Tuesday 4 September:
Morning: *Opening by President. Plenary session.*
Afternoon: *Sections.*
Wednesday 5 September:
Morning: *Plenary session.*
Afternoon: *Free.*
Thursday 6 September:
Morning: *Plenary session.*
Afternoon: *Working parties.*
Friday 7 September:
Morning: *Reports from Sections.*
Afternoon: *Closing General Session.*

In the *Plenary Sessions* invited speakers will present papers covering

i. Law and law enforcement.

ii. Pharmacological, physiological, psychological aspects, including analytical methods.

iii. The sociological aspects, including accident statistics, public information and insurance.

The *Working Parties* will be composed of experts and will discuss certain controversial points which have given rise to difficulty in practice.

The Sections will be devoted to short papers and discussions on them. The Committee of Management invites short papers on appropriate topics from intending participants. They should be submitted, typewritten, to the Secretary not later than the 31 December 1961. A Selection Sub-committee will consider them and make a suitable selection.

Language. The proceedings of the Conference will be conducted in English. It is hoped that summaries of the papers can be distributed beforehand in English, French and German.

Hotel Accommodation. Application for hotel accommodation should be made as early as possible to the Manager, Hotel Booking and Information, Ltd. (Reservations), 47 Charing Cross Road, London, W.C.2.

The minimum price for hotel accommodation in the West End of London is approximately 50s. per person for bed and breakfast but in nearby areas (Bloomsbury/Bayswater/Kensington) prices are generally lower. Rooms with private bathroom, however, are from 10s. to 20s. per person, per night, more. Invariably, a 10% service charge is added to hotel accounts. An average price in the West End might range from 50s. to 60s. for a single room and 95s. to 105s. for a double room, and in nearby areas from 30s. to 40s. for a single room and 55s. to 75s. for a double room.

Further information regarding the conference will be published in due course.

J. D. J. Havard,
Secretary.

B.M.A. House,
Tavistock Square, London, W.C.1.

Fellowships in Criminal Law

Northwestern University, Evanston, Illinois

A deadline of 15 February 1962 for submitting of applications for fellowships in the graduate criminal law program at Northwestern University has been set by Prof. Claude R. Sowle, Associate Professor in the School of Law, who administers the program.

Six fellowships will be available for the 1962-63 academic year for criminal law studies under the 1958 Ford Foundation grant to the School.

Four of the fellowship awards will go to the graduates of U.S. law schools, and 2 to graduates of foreign law schools.

Fellowship recipients in the program usually are candidates for the Master of Laws degree from Northwestern University.

A chief aim of this graduate program is the improvement of criminal justice through development and training of outstanding attorneys whose talents would be devoted principally to teaching and writing in the field of criminal law and administration.

It is open also to law graduates interested in additional special study as preparation for careers in other areas of criminal justice administration.

Graduate students in the program will be required to complete a full year of in-residence work—to include a minimum of 10 semester hours in formal courses and seminars, half devoted to subjects in criminal law and procedure, and the remainder in electives.

Each fellowship recipient also must undertake an in-depth study of an approved criminal law topic, and produce a manuscript for the *Journal of Criminology, Criminal Law and Police Science,* published by Northwestern's School of Law.

In selecting the 6 Ford Fellowship award winners, the applicant's records, demonstrated interest in the field of criminal law, and his future plans are considered by the School.

While actual experience in criminal justice administration is not a requirement, it will be considered in judging the applicant's genuine interest in this graduate work.

Complete details and application forms may be obtained now from Professor Sowle's office, located in the Northwestern University School of Law, 357 E Chicago Ave., Chicago 11, Illinois, U.S.A.

The graduate program in criminal law results from a 5-year Ford Foundation grant of $300,000 to Northwestern University for the creation and operation of short courses, special conferences and faculty research in the field.

Book Review

Criminal Science

Essays in Criminal Science. Ed. by Gerhard O. W. Mueller. (1961. Pp. 460. R 7.00).

London: Sweet & Maxwell Limited.

This book is described as a *Festschrift* in celebration of the 50th anniversary of *The Journal of Criminal Law, Criminology and Police Science.* Seventeen essays, contributed by the world's foremost criminal scientists, are presented in this the first volume of the *Publications of the Comparative Criminal Law Project of New York University.*

A contributor was free to write on any subject 'which caught his fancy,' so that it is not surprising that the essays 'traverse the entire sphere of human knowledge to which the Journal here honoured has devoted its pages from the beginning.' This has its advantages as well as its disadvantages. The field is so wide, the subjects discussed so varied, that every reader (whatever his concern with the criminal law) will find some essays of particular interest to him. On the other hand, lacking a specialist's knowledge, he may make heavy weather with *The Contribution of Psychological Testing to Criminological Theories and to Diagnosis of Mentally Abnormal Criminals,* or with an essay on *Japanese Criminal Procedure Reform: A Practical Experiment in Comparative Law.*

The changing concept of criminal responsibility is a problem discussed by several writers. Doubt, as well as approval, is expressed regarding the role which the criminal law, altered by modern legislation and theory, may be expected to play in the future society. Has the acceptance in England of the doctrine of diminished responsibility, and the recognition of the defence of psychopathic personality, been the first step towards the 'ultimate shattering of the whole idea of moral and legal responsibility in which attention will no longer be placed on the degree of an offender's blameworthiness, but instead the only question to be asked about a delinquent person will be: What is the most hopeful way of prevention of such behaviour in future?'

If so, then we seem well on the way to establishing the Erewhonian society of Samuel Butler, in which, if a man falls sick before he is 70 years old, he is sent to prison. But if he 'forges a cheque —or robs with violence—he is taken to hospital and most carefully tended at the public expense.'

On the other hand if, as other writers maintain, 'the sanction of criminal law is punishment,' then there is a danger in extending criminal responsibility to include 'negligence, strict liability and objective liability.' It should be confined to 'voluntary misconduct only.'

With the world in a state of flux, with the face of to-morrow hardly discernible, many of our social institutions are in danger. No civilization can exist without the maintenance of law and order, so there must be no weakening in the administration of justice, whatever innovations are introduced. This book, with the high authority of its contributors, will give the reader a better understanding of the problems which modern scientific thought and a rapidly changing society have brought to the criminal law.

Books Received

Forensic Medicine. By Keith Simpson, M.D. (Lond.). (1961. 4th ed. Pp. 341 + Index. With 138 Figs. R 3.95). London: Edward Arnold (Publishers) Ltd.

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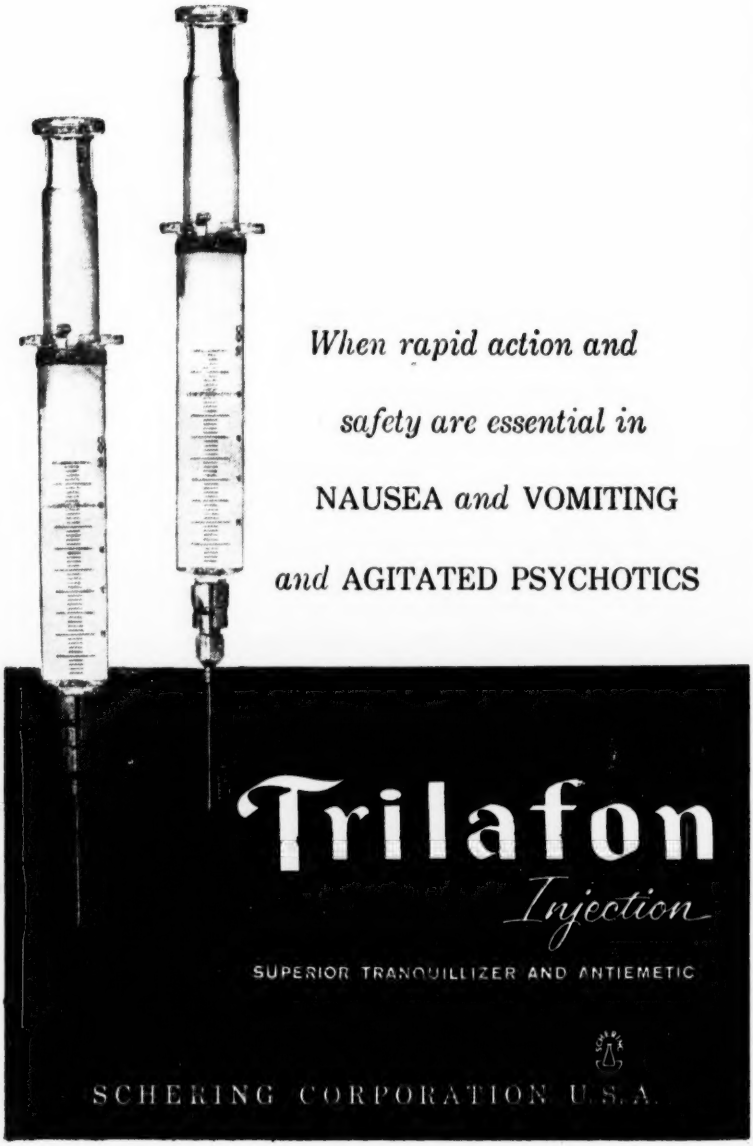

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